# Contents

# AN EXPERIMENTAL TEST OF THE WELFARISM AXIOM

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*to my family*

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## Abstract

This thesis examines the empirical testability of an implicit axiom of the Cooperative Bargaining Theory, Welfarism Axiom. The previous articles that are testing the Nash Axioms are reviewed with particular attention to the test of scale invariance axiom. Since scale invariance is not a testable axiom, what unknowingly attempted in the previous works is the test of Welfarism Axiom. In this paper, we design an experiment to test this axiom explicitly. Our experimental results are consistent with what the most known cooperative bargaining rules, Nash, Kalai-Smorodinsky, and Egalitarian, predict. Moreover, the results are consistent with what the Wefarism Axiom predicts.

**Keywords:** Bargaining, welfarism, experiment, scale invariance

REFAHÇILIK AKSİYOMUNUN DENEYSEL TESTİ

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## Özet

Bu tez, İşbirlikçi Pazarlık teorisinin dolaylı bir aksiyomu olan Refahçılık Aksiyomu'nun test edilmesini incelemektedir. Daha önce Nash Aksiyomları'nı test eden makaleler arasından ölçek değişmezliğini test edenler özel dikkat gösterilerek incelenmiştir. Ölçek değişmezliği aksiyomu test edilebilir bir aksiyom olmadığından daha önceki çalışmalarda bilmeden, test edilmek istenen aksiyom, Refahçılık Aksiyomu'dur. Bu makalede, bu aksiyomu açık olarak test eden bir deney tasarlanmıştır. Deney sonuçlarımız İşbirlikçi Pazarlık kurallarından Nash, Kalai-Smorodinsky, and Egalitarian kurallarının tahmin ettikleriyle tutarlı çıkmıştır. Buna ek olarak, deney sonuçları Refahçılık Aksiyomu'nun tahmin ettiğiyle de tutarlı bir durum sergilemiştir.

**Anahtar Sözcükler:** Pazarlık, refahçılık, deney, ölçek değişmezliği

# 1 Introduction

A typical bargaining problem, as modeled by Nash (1950) and the vast literature that has followed, is made up of two elements. The first is a set of alternative agreements on which the agents negotiate, called the *feasible set*. The second element is an alternative realized in case of disagreement, called the *disagreement point*. Both the feasible set and the disagreement point are given in the utility space. Thus, these components of a bargaining problem do not contain detailed information about physical conditions in which the bargaining takes place. In particular, the existing cooperative bargaining theory literature assumes that the realized bargaining problem is independent of physical conditions that lead to it.

In real life examples of bargaining, however, agents do not use (and are unaware of) such utility representations. When the agents bargain on some objects, one can expect the solution of bargaining to be a division of the objects, if the objects are divisible. There may also be the cases in which the bargaining is on an indivisible object. How do the bargainers proceed in this case? The answer can be bargaining via holding a lottery. Now, think about two physically different bargaining problems, described below: Firstly consider two sisters, sharing the same room, who bargain on the division of responsibilities on cleaning their room. Secondly, consider management and labor is bargaining on division of a firm's profit. Suppose these two problems have exactly the same image in utility space. According to Nash's theory, they then should have the same solution in utility terms. This is an implicit axiom of Nash theory, called the *Welfarism Axiom*. More explicitly, the axiom states that whatever the underlying economic environment, if two bargaining problems generate the same utility possibility sets and the same disagreement points, then these two bargaining problems have the same solution in utility terms.

The other axioms which are used by Nash in the characterization for the solution of a bargaining problem are: Pareto Optimality, Symmetry, Independence of Irrelevant Alternatives, and Scale Invariance. The vast literature on testing the validity of these axioms as properties of real life bargaining processes concludes that -under full information condition- when the bargainers know the other bargainers' available prize, the bargainers do not satisfy the scale invariance property. However, we claim that scale invariance is not a testable axiom. It is not an axiom on the behavior of the bargainers, but an axiom on utility representation. Nash(1950) uses von Neumann-Morgenstern (1944) utilities that are unique only up to a positive affine transformation. By scale invariance, it is required that the solution should be independent of which particular member in the family of utility functions representing the agents' preferences are chosen to describe the problem. Previous experiments employed a change in the available prizes and looked at the effects of this change as a test of scale invariance. However, the scale invariance axiom does not relate to distinct physical problems. Thus, one can expect that the results of the games, should be the same in both problems not because of the scale invariance property but because of the Welfarism Axiom. One can easily conclude that these experiments are not testing scale invariance, what they implicitly try to do is to test Welfarism Axiom.

Our contribution to the literature is performing an experiment to explicitly test the Welfarism Axiom. This experiment permits both the expected utility available to the players and the object(s) that the players bargain on to be controlled and manipulated. By looking at the previous experiments and the real life examples of bargaining when the prizes change, although the bargaining problems have the same utility representations, the results may differ in these problems.

Surprisingly enough, by the results of our experiment, changing the alternatives does not affect the division of the lottery tickets between the bargainers. In other words, the same bargaining solution, proposed by Nash (1950), is applicable for both situations. However, we believe that this result does not represent the general case for all bargaining situations. For example in Roth and Malouf (1979)'s experiment, Nash's solution was applicable while the available prizes were symmetric: the bargainers would have the same amount for their available prizes. However, the solution was not applicable when the prizes were asymmetric: the bargainers would have different amount for their available prize. In our experiment, we do not observe this distinction between the symmetric and the asymmetric cases. We believe that to be due to the following three reasons: the methods used in the experiment, the objects we give, or the subject group, the choice of the objects. This is further discussed in Section 4.

## 1.1 Literature Review

The first of the articles that examines the behavioral implications and empirical testability of game theoretical models of bargaining is Nydegger and Owen's (1975). In this paper, the authors test each of Nash's properties by observing the results of different bargaining situations. They compare the predictive values of the Nash solution with Raiffa (Kalai-Smorodinsky) bargaining solutions. Subjects bargain over the distribution of monetary payoffs and the distribution of chips (that have monetary values) about which they are fully informed. For the experiment the authors take monetary payoffs equal to utility received by bargainers. Three different games with different conditions are played to test Nash's properties. Nydegger and Owen (1975) conclude that bargaining behavior satisfies symmetry, Pareto optimality, and Independence of Irrelevant Alternatives (hereafter, IIA) but not Scale Invariance. In the third part of the experiment when a subject pair is asked to bargain over chips which have different monetary value for each, they divide chips in a way that gives equal monetary payoff to each subject. The authors claim that this finding supports the conclusion that in bargaining for money with full information about payoffs, the scale of the monetary payoffs available has an effect on the agreement reached. Moreover, the players compare their monetary payoffs that they can take with their opponents monetary payoffs and this comparison plays a role in determining the outcome. There are some flaws in this experiment in the following ways: They can not generalize all of the subjects have linear utility with monetary payoff. Moreover, they conduct the experiment face-to-face. However, according to Roth and Malouf (1979), this procedure can produce bias in the results since they conclude that in all three different bargaining conditions the subjects divide the money equally with no variance.

It is difficult to test the predictions of cooperative bargaining theory since it is almost impossible to measure bargainers' utilities. Some of the earlier papers deal with this problem by equalizing bargainers' utility to their monetary payoffs. However, the bargaining models use expected utilities. For a true test of the theory, von Neumann-Morgenstern utilities should be used. Roth and Malouf (1979) overcome this utility problem by using binary lottery games, described in the Section 3 of this paper. Roth and Malouf (1979) use this method to measure people's utilities in their experiment. They suggest information as an experimental variable to test and verify Nash axioms. They also conduct the bargaining experiments under laboratory conditions. The subjects communicate via computer without knowing their opponents' identity, seeing their opponents' face.

In Roth and Malouf (1979), the authors review the previous experiments, with particular attention to the kinds of information shared by bargainers and to the degree with which the conditions of the models have been successfully implemented. There are some differences between observed experimental results and the predictions of game theoretical models in the previous experiments. In particular, the scale invariance property is violated in studies in which each player knows the monetary value of his or her opponent's payoff. Roth and Malouf (1979) present a new mathematical result that characterizes a model of bargaining which is different from the classical model in its assumptions about information. They define a new axiom identified as the 'independence of ordinal transformations preserving interpersonal comparisons' and characterize an equal gains solution using the new axiom instead of scale invariance axiom of classical model. They conduct a new experiment to investigate the effect of difference in the quality of shared information. There are two information conditions: partial and full. Partial information means each player knows only his monetary awards and full information means both players know the other's monetary awards as well. They conclude that Nash's solution is descriptive under the partial information condition. However, under full information condition, when the monetary awards available to the players differ, the player with lower monetary award tends to claim higher percentage of the lottery tickets. In particular, the player with lower monetary award wants to equalize the expected monetary gains. Thus, under full information, the agreements reached show a shift in the direction of equal monetary gains. There are some flaws in this experiment also. For the scale invariance the authors change the available monetary payoffs for bargainers with different scales, but they do not change lottery tickets that are available in both experimental condition. (so the normalized utility possibility sets are same in both conditions.) The theory predicts no difference between two conditions in terms of lottery tickets since the utility possibility set is same but there is a shift along to the equal monetary payoffs. They interpret the result as the violation of scale invariance but as we mention in the introduction part, scale invariance is not a testable axiom that reveals bargainers' properties. Scale Invariance is a property which relates the solutions of the same problem under different utility representations of the preferences. Since they use two different problems (they change the alternatives the players bargain on), which have the same utility representation, their predictions for the problems should hold, not because of the Scale Invariance Axiom but because of the Welfarism Axiom. Thus, the violation should be due to Welfarism Axiom. Moreover, the authors claim that the results of the games under both information condition should be same because of the Welfarism Axiom. However, this experiment may not be counted as the exact test of the Welfarism Axiom since, the only difference between two games is the quality of information. In our experiment, we try to change bargaining environment more explicitly while not changing utility space. In their experiment the players are bargaining on the lottery tickets and these are their normalized utilities but there is a part which calculates expected value with the chosen lottery. This may lead bargainers to compare their monetary payoffs and to get equal payoffs at the end of the game.

Roth, Malouf and Murnighan (1981), analyze that the different agreements reached in the two information conditions in Roth and Malouf (1979) may stem either from the different message spaces in these two information conditions or from some sociological factors relating to commonly held notions of equity. Roth, Malouf and Murnighan (1981) design this experiment to investigate these effects. In this experiment the authors employ binary lottery games with prizes stated in terms of 'chips' which have monetary value. Each player always knows the number and value of chips in his own prize but a player's information about his opponent's prize is an experimental variable. The conditions, partial and full information of Roth, Malouf (1979) are replicated with 'low information' and 'high information' conditions and moreover there is an 'intermediate information' condition in which the player knows his opponent's chips' numbers but not the value of the chips. The observed results are that the low and high information conditions replicate the partial and full information conditions of the previous experiment, but the outcomes observed in the intermediate conditions do not significantly differ from those in the low information condition: the observed agreements tend to give both players equal probabilities regardless of the size of their prize in chips. Thus, comparing prizes in terms of an artificial commodity, i.e. chips, did not affect the outcomes in the same way as did equivalent information about money. This result supports the hypothesis that there is a 'social' aspect to the focal point phenomenon, that could be explained by dependence on the players' shared perception of the credibility of any bargaining position. In here, the authors define an axiom called as "Invariance with respect to strategic equivalence" which is similar to Welfarism Axiom. However, for this axiom they need strategically equivalent games, if there are such games, then the solution of these games will give the same utility. The answer of what constitutes the strategically equivalent game is as follows: Two games are strategically equivalent when there exist one to one and onto transformations from one strategy profile to the other and disagreement utility payoffs' of two games are the same. Thus the condition for strategically equivalent games differs from what the Welfarism axiom requires.

Roth and Malouf (1982) evaluates the studies of Nydegger and Owen (1975) and Roth and Malouf (1979) with respect to the violation of scale invariance and confirm the results of these studies. Additionally, they design a new experiment that is similar to the aim of Roth and Malouf (1979). The main difference of this experiment is that the bargaining concerned the division of chips (that have monetary value) rather than lottery tickets. There are 4 different experimental conditions, full information (each player knows his and his opponent's chips value) and equal payoff ( chips worth the same value to both players); partial information (each player knows only his chips' value)-equal payoff; full information-unequal payoff; partial information-unequal payoff. There are 4 different games which can be classified as allowing equal or unequal 'trade-offs' (depending on the slope of Pareto surface) and as being 'restricted' or 'unrestricted'(depending on the size of feasible set). In the first game, the number of chips that the players can take is equal (game 1:equal tradeoff & unrestricted), in the second game the maximum chips that the second player can obtain is restricted (game 2:equal tradeoff & restricted), in the third game the chips that the players can take is unequal (game 3:unequal trade-off & unrestricted), and in the last game the number of chips that second player can take is restricted (game 4:unequal trade-off & restricted). The results of games 1 and 2 in this experiment, as in the previous studies, provide a strong support for the hypothesis that in the full information condition the agreements tend to move in the direction of equal monetary gains. Thus under the full information condition, the bargaining process can be consistently observed to violate Scale Invariance. The results for games 3 and 4 allow us to draw similar conclusions about bargaining under partial information conditions. In particular, in partial information conditions, no significant differences are observed between equal tradeoff games (1 and 2) and the unequal tradeoff games (3 and 4). Under the partial information condition, the agreements tend to be those which give each player an equal number of chips. For bargaining games under the full information condition, the mean outcome seems to fall about half way between an equal division of commodity and an equal division of expected monetary value to the players. Roth and Malouf (1979) obtain the utility possibility set with binary lotteries. However, here there are no lotteries. They treat the possible division of the chips as the utility possibility set. They scale the number and value of the chips for players. Since Nash bargaining theory predict under utilities, there should also be lottery ticket bargaining in chips game.

Roth, Murnighan (1982) analyzes both information and common knowledge effects in this paper. In the games played in the partial information condition of Roth and Malouf (1979) and in the low information condition of Roth, Malouf, and Murnighan (1981), neither player knows his opponent's prize, while in the games played in the full information condition of Roth and Malouf (1979) and in the high information condition of Roth, Malouf, and

Murnighan (1981), both bargainers know their opponent's prize. In these experiments, 'common knowledge' whether the bargainers know one another's prizes is. However, here the authors make a new experiment in which common knowledge condition is used as an experimental variable also. In the experiment, the lower prize is \$5 and the higher prize is \$20. They use 4(information)$\times$2(common knowledge) factorial design. The first factor is information and the second factor that made this information common knowledge for the half of the bargaining pairs and not common knowledge for the other half. For instance, when the \$20 player will know both prizes, then the (common) instructions to both players reveal that the \$20 player will know both prizes and that the \$5 player will know only his own in the game about to be played. In the non-commonknowledge condition, the \$20 player still knows both prizes and the \$5 player still knows only his own prize, but both players are told that the other bargainer may or may not know their prizes. The difference between the outcomes in the different information conditions could depend on whether a) neither player knows his opponent's prize. b) the player with higher prize know both prizes, c) the player with lower prize know both prizes, or d) both players know both prizes. The experiment designed here is to separate these possible effects.

The present experiment explores the component causes of this information effect and investigates the equilibrium properties of the observed behavior. The authors reach 3 principal conclusions: 1) the effect of information on what agreements are reached is primarily a function of whether the player with smaller monetary prize knows both prizes. 2) whether this information is common knowledge influences the frequency with which disagreements occur. 3) the regularities among these unpredicted effects of information make it unlikely that they can be attributed to mistaken or irrational behavior on the parts of bargainers.

By comparing three experiments of Roth and Malouf (1979), Roth, Malouf, and Murnighan (1981), and Roth and Murnighan (1982) we can look at the cause of the observed information effects. In the first experiment, Roth and Malouf (1979) demonstrates that an effect of information about the monetary prizes which could not be accounted for in terms of preferences over the set of lotteries. The second experiment Roth, Malouf, and Murnighan (1981) shows this effect could not be accounted for by the set of available actions (strategies). The third experiment shows that the effect is consistent with rational behavior. Thus, Roth and Murnighan (1982) attribute the cause of the information effect to a change in the players' subjective beliefs.

In Roemer's book, "Theory of Distributive Justice" (1998) chapter 2 & 3, "Axiomatic Bargaining Theory" and "Economic Foundations of Welfarism" are also related. Chapter 2 can be summarized as follows: For cooperative bargaining solutions, knowledge of the possible set of utility points and disagreement utility points about a bargaining problem is sufficient to solve the problem. Chapter 2's most important criticism by Roemer about the Nash Bargaining Rule is that Nash's approach gives no compelling reason why bargainers should ignore the underlying economic environment. Roemer defines an appropriate economic environment by finite set of objects, probability distribution on partition of these objects, utilities for agents and a fixed (disagreement) lottery. He then defines the axiom of welfarism and restates the Nash axioms for this economic environment. He first shows that without welfarism, the Nash axioms hardly restrict the mechanism. They characterize plenty of solutions. However, when the welfarism axiom is added to the restated Nash axioms, one admissible mechanism exists: the Nash solution. In Chapter 3, the author defines the economic environment differently. Here, an economic environment consists of a problem in which a given bundle of resources must be divided among $H$ persons with given utility functions. He introduces a new axiom, Axiom of Consistency of Resource Allocation across Dimension (hereafter, CONRAD), that helps a certain kind of dimensional consistency on the allocation mechanism. It is a weak version of welfarism. CONRAD, along with other plausible axioms, turns out to imply welfarism. He benefits from the CONRAD axiom mostly -in addition to weak version of other Nash axioms- in the characterizations of bargaining rules (Nash, Kalai-Smorodinsky, Egalitarian, and Dictatorship) on economic environments.

Although economic environments contain more information than does the utility possibilities set, one can claim that even more information is needed for purposes of distributive justice, in particular, what the utility represents and what the resources are in question.

Yaari, Bar, Hillel (1984) make an experiment in which the problems of choosing the most just mechanism to allocate resources between two people are presented to the subjects. The utility function between the problems changes as an experimental variable according to its representation of a need or as a representation of willingness to pay. In this way, two utility functions are derived and some initial endowment of two different goods are given. In the first part of experiment, utility functions are defined according to the needs of agents; the second part, they are defined according to willingness to pay. Although the derivation of utilities differ, the utility functions in the first and second parts of the experiment are the same, as is the set of feasible payoffs. However, the responses of subjects differ in choosing the most just distribution method. In the third part, utility functions are derived according to the needs and that differ from the utilities in the first and second parts, but the set of feasible payoffs is the same in all the parts of the experiments. The choices of subjects as just distribution again differ from first and second parts of the experiment. Here although the utility functions are given, (they may not reflect the exact utilities of the players) and generate the similar utility possibility set, the subjects chose a different allocation mechanism in terms of the most just allocation. In the view of the Welfarism Axiom, if different allocations give the same utilities to the players then they may change their minds according to justice, but if the utilities change with the allocations, according to Welfarism Axiom, the same mechanism should be chosen when the utility possibility set does not differ.

Other representations for bargaining also differ from the representation by the utility possibility set and the disagreement point on this set. Nicolo and Perea (2005), represent two person bargaining problems by a space of alternatives, a status quo point, and the agents' preferences on the alternatives. They introduce the notion of increasing sets which reflects a particular way of gradually expanding set of alternatives. For any given family of increasing sets, they present a solution which is Pareto optimal and monotonic with respect to this family. They show this solution is unique with additional two axioms to the above axioms. They also provide a noncooperative bargaining procedure for which the unique backward induction coincides with the solution.

# 2 Cooperative Models of Bargaining

Before entering the discussion of the Nash's bargaining model, we briefly consider the elements of expected utility theory on which cooperative bargaining models depend. von Neumann and Morgenstern (1944) were the first to demonstrate conditions on an individual's preferences which are sufficient so that the individual's choice behavior over risky events is the same as if the individual were maximizing the expected value of a real valued function called this individual's *utility function*. Given sufficient information about an individual's preferences, a corresponding utility function can be constructed, although this function is uniquely defined only up to an interval scale.

For simplicity, consider the case in which the set of alternatives, $A$ contains elements $a$ and $c$ such that $a$ is strictly preferred to $c$, and for any alternative $b$ in $A$, the player likes $a$ at least as well as $b$, and $b$ at least as well as $c$. Then if $u$ is a utility function representing this individual's preferences over the set of alternatives $A$, it must have the property that $u(a) \geqq u(b) \geqq u(c)$. Since $u$ is defined only up to an interval scale, we may arbitrarily choose its unit and zero point. In particular, we may take $u(a) = 1$ and $u(c) = 0$. The problem of determining $u(b)$ then becomes the problem of finding the appropriate value between 0 and 1 so that all those lotteries over alternatives that the individual prefers to $b$ have a higher expected utility, and all those lotteries to which $b$ is preferred have a lower expected utility. Let us denote the lottery that with probability $p$ yields alternative $a$ and with probability $(1-p)$ yields alternative $c$ by $L(p) = [pa; (1-p)c]$. Then the utility of participating in the lottery $L(p)$ is its expected utility, $pu(a) + (1-p)u(c) = p$. If $p$ is the probability such that the individual is indifferent between $b$ and $L(p)$, then their utilities must be equal, $u(b) = p$. Thus, when we say that the utility of alternative $b$ to a given individual is known, we mean that the probability $p$ is known such that the individual is indifferent between having alternative $b$ for certain or having the risky alternative $L(p)$.

For instance, consider an individual faced with a choice of receiving half a million dollars for certain or participating in a lottery that will yield a million dollars with probability $p$

and yield zero dollars with $(1-p)$ probability. Then if we set the individual's utility function for zero dollars at 0 and set the utility for a million dollars at 1, determining the individual's utility for a half million dollars means determining the probability $p$ that would leave this individual indifferent between the lottery and the half-million dollars. Most of us would require $p$ to be considerably greater than one-half before we could take the lottery over the assured half million. This means, our utility function is not linear in money; our utility for half a million dollars is more than half-way between our utility for zero dollars and our utility for a million dollars. Thus, when we say that an individual knows another's utility for a given event, we mean that this individual can determine an equivalent lottery of the sort just described by knowing the other's preferences.

Now we can define the bargaining problem as originated in a fundamental paper by Nash (1950). There, Nash introduced an idealized representation of the *bargaining problem* and developed a methodology to find a solution for bargaining problem that had been noted by Edgeworth (1881).

The formal and abstract model is as follows: Two agents have access to any of alternatives in some set, called *the feasible set*. Their preferences over these alternatives differ. If they agree on a particular alternative, that is what they get. Otherwise, they end up at a prespecified alternative in the feasible set, called *the disagreement point*. Both the feasible set and the disagreement point are given in utility space. Let them be given by $S$ and $d$ respectively. Nash's objective is to develop a theory that would help predict the compromise the agents would reach. He specifies a natural class of bargaining problems to which he confines his analysis, and he defines a *solution,* to be a rule that associates with each problem $(S, d)$ in the class a point of $S$, to be interpreted as this compromise. He formulates a list of properties, or axioms, that he thinks solution should satisfy, and establishes the existence of a unique rule satisfying all the axioms.

A 2 person **bargaining problem** is a pair $(S, d)$ where $S$ is a subset of 2 -dimensional Euclidean space, and $d$ is a point of $S$. The properties related with $S$ can be ranked as follows:

**(i)** $S$ is convex, bounded, and closed (it contains its boundary).

**(ii)** There is at least one point of $S$ strictly dominating $d$.

Each point of $S$ gives the utility levels measured in some von Neumann- Morgenstern scale, reached by agents through the choice of one of the alternatives, or randomization among those alternatives, available to them. Convexity of $S$ is due to the possibility of randomization; boundedness holds if utilities are bounded; closedness is assumed for mathematical convenience. The existence of at least one $x \in S$ with $x > d$ avoids a degenerate case when only some of the agents stand to gain from the agreement. In addition, we will usually assume that

**(iii)** $(S, d)$ is **d-comprehensive:** If $x \in S$ and $x \geqslant y \geqslant d$, then $y \in S$.

This property of $(S, d)$ follows from the assumption that utility is freely disposable (above $d$)

Let $PO(S)$ denote the set of **Pareto optimal profiles in** $S$**:** $x \in PO(S)$ if and only if $x \in S$ and or each $x' \geqslant x$, $x' \notin S$.

Nash models the bargaining process by a function, called a bargaining rule, that selects a feasible outcome for every bargaining problem. The **bargaining rule** is $f : (S, d) \longrightarrow \mathbb{R}^2$ where $f(S, d)$ is an element of $S$. Nash proposes there is a unique rule which possesses the following properties:

**Axiom 1** *Pareto Optimality:* $f(S, d) \in PO(S)$

This property means the bargaining solution does not yield an outcome which is less desirable for all players than some other feasible outcome.

Let $\pi$ be a permutation such as $\pi(x_1, x_2) = (x_2, x_1)$ for $(x_1, x_2) \in \mathbb{R}^2$

**Axiom 2** *Symmetry: If* $\pi(S) = S$ *and* $\pi(d) = d$ *then* $f_1(S, d) = f_2(S, d)$.

This property means if there is no distinction between the players then the solution should be the same for both players.

**Axiom 3** *Independence of Irrelevant Alternatives (hereafter, IIA): If* $(S, d)$ *and* $(T, d)$ *are bargaining games such that* $S$ *contains* $T$*, and if* $f(S, d)$ *is an element of* $T$ *then* $f(T, d) = f(S, d)$.

The third property means that when there is a best outcome in the feasible set $S$, it would continue to be the best outcome in any smaller set $T$.

The last property is related with the fact that the game $(S, d)$ is interpreted in terms of the expected utility functions of the players, which are defined only up to an interval scale, that is, only up to an arbitrary choice of origin and unit. It states that if a game $(S', d')$ is derived from $(S, d)$ by transforming the utility functions of the players to equivalent representations of their preferences, then the same transformation applied to the outcome of the game $(S, d)$ should yield the outcome of the game $(S', d')$. In other words, this means the solution should depend only on the preferences of the players, not on any arbitrary features of the utility functions that represent these preferences.

Let $\Lambda^2 : \mathbb{R}^2 \longrightarrow \mathbb{R}^2$ be the class of independent person by person, positive, linear transformations (”scale transformations”): $\lambda \in \Lambda^2$ if there is $(a, b) \in \mathbb{R}^2_{++}$ such that for all $x \in \mathbb{R}^2$, $\lambda(x) = (a_1x_1 + b_1,\ a_2x_2 + b_2)$. Given $\lambda \in \Lambda^2$ and $S \subset \mathbb{R}^2$, $\lambda(S) \equiv \{x' \in \mathbb{R}^2 | \exists x \in S with x' = \lambda(x)\}$

**Axiom 4** *Scale invariance:* $\lambda(f(S, d)) = f(\lambda(S), \lambda(d))$

Since the choice of origin and the scale for each player’s utility function is unrelated to that of the other player’s, this property essentially specifies that the numerical levels of utility assigned to each outcome have no standing in the theory. Suppose two bargainers whose utility functions of an alternative set is $u_1$, $u_2$ respectively and they agree on an alternative that is represented in the utility space of the alternatives also. When the utility of bargainers is scaled on the same alternative set, say the first of the bargainers gets $3u_1$, and the second one gets $6u_2$, they would agree on the same alternative on the same physical environment but the image of this alternative on the utility possibility set would give 2 times more to the first bargainer and 5 times more to the second bargainer. Thus, although the bargaining

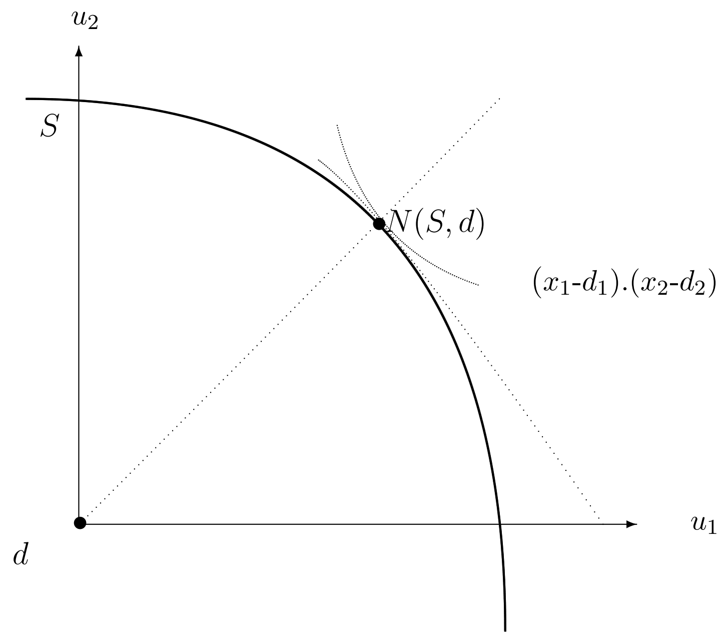


Figure 1: The Nash Solution

problem does not change in physical respect, the result in the utility possibility set is scaled in the same way with the utilities of the bargainers.

**Definition 5** *The Nash bargaining solution is a maximizer of the product* $(x_1 - d_1)(x_2 - d_2)$ *for all points* $x$ *in* $S$ *with* $x \geqslant d$. *(Look at Figure 1)*

By using four properties in the above, Nash (1950) proves the following theorem:

**Theorem 6** *The Nash bargaining solution is the only solution satisfying the four axioms above.*

This theorem means in the region of $S$ yielding positive gains to both players, Nash's solution selects a unique point $f(S, d)$ that maximizes the geometric average of the gains available to the players, as measured against their disagreement payoffs. This is the only solution that possesses the axioms above.

There are also other solutions for the bargaining problem. One of them is Kalai-Smorodinsky solution described as in the below:

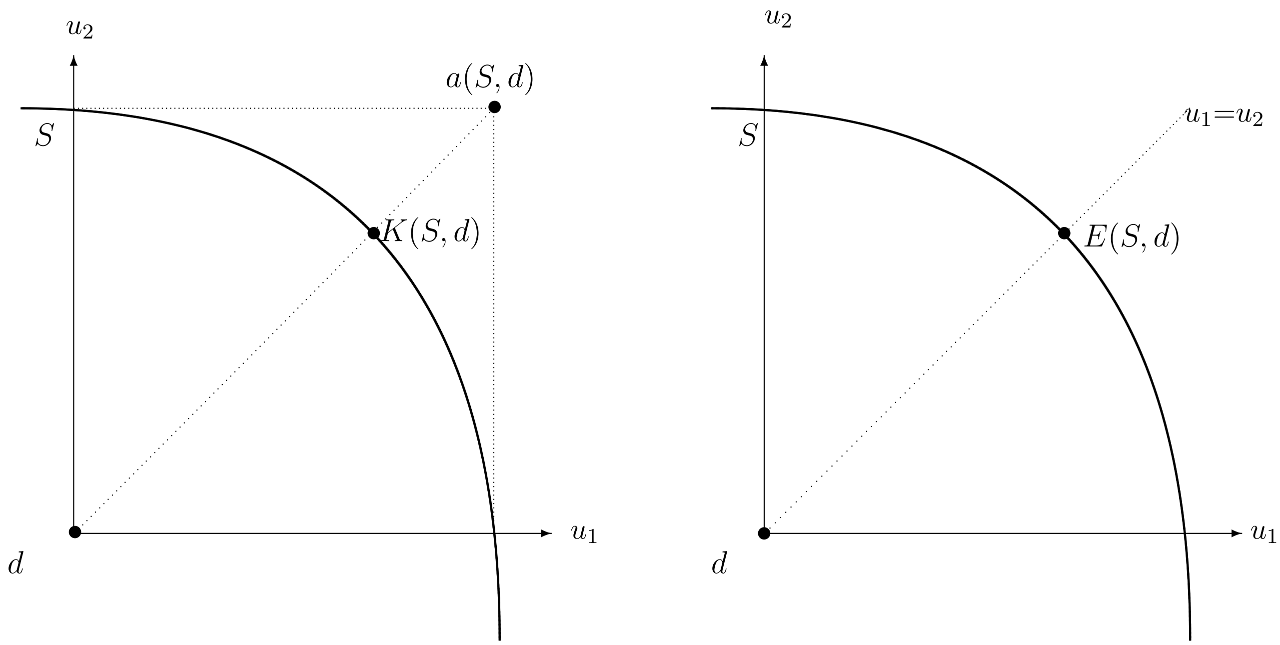


Figure 2: The Kalai-Smorodinsky and the Egalitarian Solutions

**Definition 7** *The Kalai-Smorodinsky solution is the maximal point of $S$ on the segment connecting $d$ to $a(S)$, the ideal point of $S$, defined by $a_i(S) \equiv \max\{x_i \mid x \in S\}$ for all $i$.(Look at Figure 2)*

Some of the above axioms have been criticized. Among these, the most controversial one is IIA. Firstly Kalai-Smorodinsky (1975) proposes a new axiom, Individual Monotonicity, instead of IIA. Here, it is required that an expansion of the feasible set "in a direction favorable to a particular agent" always benefits him: one way to formalize the notion of an expansion favorable to an agent is to say that the range of utility levels attainable by agent $j$ $(j \neq i)$ remains the same as $S$ expands to $S'$, while for each such level, the maximal utility attainable by agent $i$ increases. Let $a_i(S) \equiv \max\{x_i \mid x \in S\}$ be ideal point for agent $i$.

**Axiom 8** *Individual Monotonicity: If $S' \supseteq S$, and $a_j(S') = a_j(S)$ for $j \neq i$, then $f_i(S', d) \geqslant f_i(S, d)$.*

The Kalai-Smorodinsky solution sets utility gains from the disagreement point proportional to the agents' most optimistic expectations. For each agent, this is defined as the highest utility he can attain in the feasible set subject to the constraint no agent should receive less than his coordinate of the disagreement point.

By simply replacing IIA by Individual Monotonicity, that is used in the characterization of Nash solution, we obtain a characterization of Kalai-Smorodinsky solution.

**Theorem 9** *The Kalai-Smorodinsky solution is the only solution satisfying Pareto-optimality, symmetry, scale invariance, and individual monotonicity.*

The other solution for the bargaining problem is the Egalitarian Solution. It can be stated as follows:

**Definition 10** *The Egalitarian solution is the maximal point of $S$ whose coordinates are all equal. (Look at Figure 2.)*

Let $WPO(S)$ denote the set of **Weak Pareto optimal profiles in $S$:** $x \in WPO(S)$ if and only if $x \in S$ and or each $x' > x$, $x' \notin S$.

**Axiom 11** *Weak Pareto Optimality: $f(S,d) \in WPO(S)$*

The Egalitarian solution, introduced by Kalai (1977), performs the best from the viewpoint of monotonicity and the characterization offered in the below based on this fact. The monotonicity condition used is that all agents should benefit from any expansion of opportunities; this is irrespective of whether the expansion may be biased in favor of one of them as in the Individual Monotonicity Axiom.

**Axiom 12** *Strong Monotonicity: If $S' \supseteq S$, then $f(S',d) \geqq f(S,d)$*

**Theorem 13** *The Egalitarian solution is the only solution satisfying weak Pareto-optimality, symmetry, and strong monotonicity.*

Bargaining problem is represented by the utility space in all of these three theorems. Thus, one can simply conclude that the most important distinction between two bargaining problems is their representations in the utility space. Although the bargaining problems are physically different, if they have the same utility representations, then the solutions that are proposed by the above theorems will lead the same utility for these different bargaining problems. This result can be explained in a formal way firstly by stating what a physical bargaining problem is.

We will give a model of physical bargaining problem for 2 agents. There are four components of a physical bargaining problem: The set of feasible agreements (described in physical terms) represented by $X$, the disagreement event represented by $D$, preference profiles of agent 1 and agent 2, $\succeq_1$ and $\succeq_2$ on the space of the lotteries over $X$ and $D$. Thus a physical bargaining problem is represented by $\langle X, D, \succeq_1, \succeq_2 \rangle$. A mechanism $\varphi$ maps any physical bargaining problem, $\langle X, D, \succeq_1, \succeq_2 \rangle$, into a member of $X \cup \{D\}$.

**Axiom 14** *Welfarism Axiom: Suppose there are two different bargaining problems denoted by $\langle X, D, \succeq_1, \succeq_2 \rangle$ and $\langle X', D', \succeq'_1, \succeq'_2 \rangle$. Suppose the preference profile $(\succeq_1, \succeq_2)$ can be representable by $u = (u_1, u_2)$ and $(\succeq'_1, \succeq'_2)$ can be representable by $v = (v_1, v_2)$. If $u\,(X, D, \succeq_1, \succeq_2) = v(X', D', \succeq'_1, \succeq'_2)$ and $u(D) = v(D)$ then $u(\varphi(X, D, \succeq_1, \succeq_2)) = v(\varphi(X', D', \succeq'_1, \succeq'_2))$.*

For instance, consider two bargainers. These individuals bargain on 100 lottery tickets and each ticket will give 1% chance of getting their prize. In the first game, their available prizes for the bargaining are the same, a chocolate bar. Their utilities from the object are normalized as follows: if one of the bargainers gets the chocolate bar, his utility will be normalized to 1, if he gets nothing his utility is normalized to 0. Assume that the bargainers agree on some division of the lottery tickets in this problem. The result will give us the utilities of the bargainers for this problem. Now, consider another bargaining problem with different players. The object that they bargain on and the available prizes for the bargainers are changed. The available prize for the first player is 2 cans of tuna and the available prize for the second player is 1 can of tuna. The players' utilities are normalized as follows: If one of the players gets his available prize, he gets 1, if he gets nothing, his utility is normalized to 0. Since the expected utilities of the bargainers are equal to the number of lottery tickets by the normalization of the players' utilities from their prize, both problems have the same utility representation as in Figure 1, that is all possible division of the lottery tickets. By the above axiom, we expect the same division of the lottery tickets for these two problems since they have the same utility representations.

# 3 Experiment

The experiment reported here is designed to test the hypothesis that two different physical environments leading to the same possible utility set have the same utility solution for the problems. Since the cooperative bargaining models are defined in terms of the players' utilities, experimental tests of such models should be constructed in a way which permits the players' utilities to be determined. Roth and Malouf (1979) achieved that via binary lottery games method. In a bargaining game in which the feasible agreements are the appropriate kind of lotteries, knowing the utilities of the players at a given agreement is equivalent to knowing the lottery they have agreed on. We used this method in our experiment also.

In each game of this experiment, players bargain over the probability that they would receive a certain prize. In particular, they bargain over how to distribute lottery tickets that would determine the probability that each player would win his personal lottery. For instance, a player who receives 60% of the lottery tickets would have 60% chance of winning his prize and 40% chance of winning nothing. If the bargainers could not reach an agreement in the allotted time, each player receives nothing. Then, we normalize each player's utility function by giving utility 1 to receive his prize and by giving 0 to receive nothing. We equate an individual's expected utility for a given agreement to the lottery he thinks as desirable as that agreement. Then the player's utility for any lottery between these two alternatives is the probability of winning the lottery. In particular, an agreement which gives a player $p$ percent of lottery tickets gives him a utility of $p$.

Since the experimental variable for two games is the physical environment, in the games we change bargaining alternatives. Our work is related to previous tests of scale invariance in the literature. We examine whether changing the object that is bargained on affects the behavior of the bargainers or not. Each player plays two games, in random order, against different opponents. In the first game, Game 1, both players have the same potential prize, 1 chocolate bar. In the second game, Game 2, one of the players has 2 cans of tuna as his potential prize and the other has 1 can of tuna (See Table 1). There are also two roles for the subjects during the experiment: Player A and Player B. The role difference does not have much effect on the result of the game as it would in a noncooperative game such as the Ultimatom Game[1] or the Dictatorial Game[2]. The agents with the role of Player A will start the bargaining only. Moreover, to avoid any bias arising because of the roles, we give the right of being in both roles to all of the subjects. Some of the subjects who are in the role of Player A in the first game, would be Player B in the second. Besides this condition, there are no instructions for players on how to bargain.

To interpret the set of feasible outcomes in both games in terms of each player's utility function for the prize to be normalized so that the utility for receiving his own prize is 1, and the utility for not receiving it is 0, then the player's utility for any lottery between these two alternatives is the probability of winning the lottery (See Figure 3).

Table 1

*Prizes for Game 1 and 2.*

| **Game** | **Prize for Player A** | **Prize for Player B** |
|---|---|---|
| 1 | 1 chocolate bar | 1 chocolate bar |
| 2 | 2 cans of tuna | 1 can of tuna |

## 3.1 Predictions of the Models

Since classical cooperative bargaining theory models depend only on the feasible set of utility payoffs, in both games we should look at the possible distribution of lottery tickets. Axiom 1, Pareto Optimality, predicts that in both games agreements will be reached and all of the

[1]In this game two players are alloted a sum of money. The first player, often called the Proposer, offers some portion of the money to the second player, called the Responder. If the Responder accepts, she gets what was offered, and the Proposer gets the rest. If the Responder rejects the offer both players get nothing.

[2]In this game two players are alloted a sum of money. The Proposer, offers some portion of the money to the Responder. Both take the offered money.

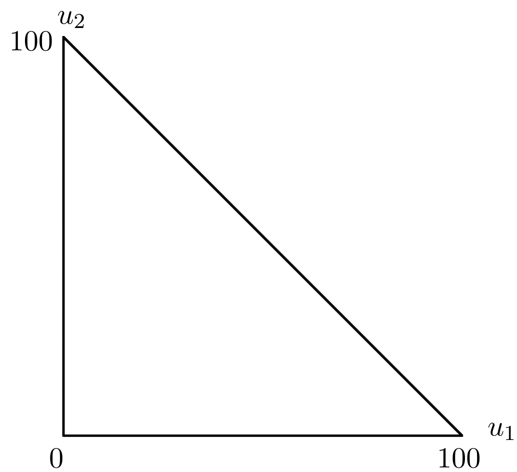


Figure-3 The utility images of both games

lottery tickets will be divided between bargainers. Axiom 2, Symmetry, predicts that in Game 1 the players will receive equal percentages of the lottery tickets. (Thus Axiom 1 and Axiom 2 together imply a 50-50 split in Game 1.) The implicit axiom of the cooperative bargaining models, Welfarism Axiom, predicts that Game 2 will reach the same outcome as Game 1. (Since with the normalization of the utilities, both games have the same utility representation.)

Since Nash bargaining solution satisfies the axioms above, it predicts a 50-50 split in both games. The same prediction is made by the Kalai-Smorodinsky and Egalitarian solutions, since these rules also satisfy the Axiom 1 and Axiom 2.

In what follows, it will be convenient to discuss the predictions of the models in terms of the quantity $D$, defined as the percentage of the lottery tickets received by Player A minus the percentage of the lottery tickets received by Player B. The predictions of the above solutions are that $D$ will equal 0 for both games.

Our principal experimental hypothesis is that when we change the alternatives given and when the amount of available prize differs between the players, the players continue to divide lottery tickets evenly between themselves. However, this is not the case in the previous experiments. Thus, we expect to reject the hypothesis. More explicitly, in Game 2 we expect to come across a situation like Roth and Malouf (1979), when we change the objects creating an asymmetry between the players, the players would divide the lottery tickets by considering the asymmetry between themselves.

## 3.2 Method

*Subjects.* The subjects are drawn from one of the undergraduate courses taken primarily by college sophomores. No special skill or experience is required for participation. Pretests are run with a different subject group to improve the quality of instructions in understandability and clarity.

*Procedure.* The experiment is conducted in two rooms. One room contains 15 computers and the other contains 18 computers. In total, there are 36 subjects, that is 18 pairs of them, two sessions of the experiment: 13 of the pairs belong to the first session and 5 of the pairs belong the second session. In one of the rooms, subjects with the role of Player A are located, and in the other, subjects with role of Player B are located. Each participant is seated at a terminal of a computer supported by the internet program, Msn-Messenger. This program allows subjects to communicate freely. However, the subjects are instructed to only communicate offers. Their communication is monitored by the experimenter. The subjects get a quiz grade as participation award. When the subjects do not obey the rules of experiment, they are not awarded for participation. The computer program records all the messaging between the subjects and the records are later reviewed to verify that the subjects only transmitted offers and no other messages.

A complete copy of the instruction papers can be found in Appendix A. The first page of the instructions include necessary information about using Msn-Messenger. Moreover, it includes the 'log in' information to the program. Subjects are asked to log in to the program using this information. There is a section for them to write their real name to identify them to give their prize. In the second page, since they play the games in random order, the objects that are bargained on can change. Nine of the subjects firstly bargain on the chocolate bar and then bargain on the canned tuna. Nine of them have the inverse situation. The prize of the game is written on the top of the page for the player. After that, the role of the player is written. As mentioned, Player A is the one who starts. Through a random matching of the subjects, a pair is determined. They are instructed to add themselves and the experimenter to their contact list and start a conversation at the end of the explanation of the instructions. To their conversation they are also instructed to add the experimenter who will follow the proceeding of the bargaining.

The main tools of the bargaining are then introduced: sending proposals. The subjects are told there are 100 lottery tickets and they should agree on a division these tickets in the allotted time. Each lottery ticket gives 1% of chance to get their prize. A proposal is a pair of numbers, the first of which is the number of sender's lottery tickets and the second is the number of receiver's lottery tickets. Then they are instructed in the rules of the experiment, which are: (i) not to talk to anyone during the game, (ii) not to talk to their opponents except proposals, (iii) not to start bargaining without experimenter's call for start.

There is a third page which cannot be opened directly while the subjects are in their first game. The subjects are to complete their bargaining in 8 minutes. They are told that unless they can have an agreement in 8 minutes, none of them gets the prize. The ones who finish before 8 minutes, wait for the others quietly without leaving their seats. At the end of 8 minutes subjects are instructed to open the third page. In this page, each of the subjects has three main changes from the previous game. Firstly their prizes for the bargaining changes. If they bargain on the chocolate bar, they bargain on the canned tuna and if they bargain on the canned tuna they bargain on the chocolate bar. Secondly their roles in the bargaining changes. Lastly they bargain with a different opponent in the second part. The same rules are valid during this game also.

The lotteries are held after the experiment and each player is informed of the outcome and winnings. A brief explanation of the purpose of the experiment is then given.

## 3.3 Results

Table 2

*Means and Standard Deviations for D*

| Statistics | | |
|---|---|---|
| Games | Mean | Standard Deviation |
| 1 (for chocolate bar) | 0,67 | 2,83 |
| 2 (for cans of tuna) | -0,22 | 6,02 |

There are 36 games played, 18 games on the chocolate bar and 18 games on the can of tuna. The 25 games result in an agreement (69%). Particularly, 11 of the 18 games on the chocolate bar and 14 of the 18 games on the canned tuna result in agreement.

In each game, the players do not know who they are bargaining with and a different random pairing of the subjects are performed to avoid any history effect. We use within subject design, i.e. in two stages of the experiment, the same subject group is used. We make the subjects play the games in random order to minimize the effect of practice. Among the 18 games played in the first stage 9 games are on chocolate bar and 9 games are on canned tuna. The results of bargaining on chocolate bar in the first stage and in the second stage are as in Table 3.

Table 3

*Means and Standard Deviations for D*

| | Statistics | |
|---|---|---|
| Games | Mean | Standard Deviation |
| Stage 1 | 0 | 0 |
| Stage 2 | -1,33 | 4 |

The results of bargaining on canned tuna, in the first stage and in the second stage are as in Table 4.

Table 4

*Means and Standard Deviations for D*

| | Statistics | |
|---|---|---|
| Games | Mean | Standard Deviation |
| Stage 1 | -0,44 | 8,76 |
| Stage 2 | 0 | 0 |

To test whether the games on chocolate bar played in the first stage and in the second stage are significantly different, we use t- test, $t(16) = \frac{-1.33}{\sqrt{\frac{16}{9}}} = -1$. That means, the games on chocolate bar played in the first stage and in the second stage are not significantly different.

If we apply the same procedure to the games on canned tuna, $t(16) = \frac{-0.44}{\sqrt{8.76\frac{8.76}{9}}} = -0.15$. That means, the games on canned tuna played in the first stage and in the second stage are not significantly different.

If we compare the two stages in terms of the frequency of disagreement, in the first stage of bargaining on chocolate bar there are 3 disagreements. However, in the second stage there are 4 disagreements. There is 33,3 percent increase in the number of disagreements. Nevertheless, this is not the case in the bargaining on canned tuna. In these games, there are 2 disagreements in the first stage and this number does not change in the second stage.

Since we find there is not significant difference between the first and second stage games (There is not significant effect of practice.), we can evaluate the results together as in the following.

Table 2 gives means and standard deviations of $D$ for the data of bargaining of both stages on chocolate bar and canned tuna. (The unaggregated data is given in Table 5.) Games 1 and 2 are not significantly different from zero, $t(n-1=17) = \frac{0{,}67-0}{2{,}83/\sqrt{18}} = 1$ and $t(17) = \frac{-0{,}22-0}{6{,}02/\sqrt{18}} = -0,16$ respectively. Since for the first game, $t$ test value (which is equal to 1) is less than $t$ table value (which is 2.90 for significance level 0.01), we cannot reject the mean of the first game is 0. Additionally for the second game, $t$ test value (which is equal to -0,16) is less than $t$ table value (which is 2.90 for significance level 0.01), we cannot reject the mean of the first game is 0. If we compare Game 1 and Game 2 within conditions, $t$ test shows that Game 1 is not significantly different from Game 2,

$t(n_1 + n_2 - 2 = 34) = \frac{0{,}67+0{,}22}{\sqrt{\frac{(2{,}83)^2}{18}+\frac{(6{,}02)^2}{18}}} = 0,57$. Finally, in here $t$ test value equals to 0,57 while the table value is 2,73 in the significance level 0.01. Therefore, we cannot reject the hypothesis that the mean of $D$ for game 1 equal to the mean of $D$ for game 2.

Thus the results are consistent with the hypothesis that the theorems introduced in the 'Cooperative Bargaining Models' part only depends on the possible utility set. As we see from our experiment, giving a canned tuna or a chocolate bar as a prize to the subjects or creating asymmetry in the available prizes do not cause significant changes in the results. Moreover, the results are consistent with the prediction of Nash Solution, Kalai-Smorodinsky Solution, and Egalitarian Solution.

Table 5

*Summary of final agreements*

| Game 1 | | | Game 2 | | |
|---|---|---|---|---|---|
| Player 1 | Player 2 | $D$ | Player 1 | Player 2 | $D$ |
| 50 | 50 | 0 | 50 | 50 | 0 |
| 50 | 50 | 0 | 50 | 50 | 0 |
| 50 | 50 | 0 | 0 | 0 | 0 |
| 0 | 0 | 0 | 40 | 60 | -20 |
| 0 | 0 | 0 | 48 | 52 | -4 |
| 50 | 50 | 0 | 50 | 50 | 0 |
| 0 | 0 | 0 | 50 | 50 | 0 |
| 0 | 0 | 0 | 0 | 0 | 0 |
| 50 | 50 | 0 | 50 | 50 | 0 |
| 56 | 44 | 12 | 0 | 0 | 0 |
| 50 | 50 | 0 | 50 | 50 | 0 |
| 0 | 0 | 0 | 50 | 50 | 0 |
| 0 | 0 | 0 | 50 | 50 | 0 |
| 50 | 50 | 0 | 0 | 0 | 0 |
| 50 | 50 | 0 | 55 | 45 | 10 |
| 50 | 50 | 0 | 55 | 45 | 10 |
| 50 | 50 | 0 | 50 | 50 | 0 |
| 0 | 0 | 0 | 50 | 50 | 0 |

## 4 Discussion

The result of this experiment provides strong support for the Welfarism Axiom. As the Nash's rule, Kalai-Smorodinsky's rule, and the Egalitarian solution predict, we expect that the lottery tickets should be divided evenly in the first part of the experiment and by the prediction of the axiom, it continues to be divided evenly in the second part since the utility representations of the first and second part are the same (See Figure 3). Previous results on the scale invariance axiom seem to suggest that Welfarism Axiom will be violated. For instance, in the experiment of Roth and Malouf (1979), when the available monetary payoff of the subjects differ in a game, the one having less available monetary payoff tend to claim more of the lottery tickets. Thus, we expect, creating asymmetry between the players with respect to prizes, as in the second part of our experiment, leads the subject having 1 can of tuna as his prize to claim more lottery tickets. However, as $t$ test shows us there is no significant difference between two games. This result may be due to the following reasons:

1) The objects may be effective on the experiment results : We are not sure whether all of the subjects love the chocolate bar or cans of tuna. These objects may be undesirable for some subjects and there may not be any meaning for them to bargain on these objects. However, while choosing the objects, we consider the objects to be desirable for most of the students. In the previous experiments reviewed in this paper, mostly money or chips that have monetary value is used. Thus there is no problem about the desirability of the bargained objects in these experiments.

2) The subject group may be effective : If the subjects think that these objects are not valuable enough, their bargaining behavior might be different than predicted. The monetary values of these objects are as follows: chocolate bar: 1.4 YTL, 1 can of tuna : 3.2 YTL, and 2 cans of tuna: 4.8 YTL. Since they may think that these objects do not have much value, there is no reason to bargain for these objects. The only reason they participate in the experiment may be the quiz grade that would be given at the end of the game. This observation might also explain the high disagreement rate in the experiment. The disagreement rate of this experiment (%31) is higher than the disagreement rate of Roth and Malouf (1979)'s experiment (%5).

3) The problems related with the design and implementation of the experiment : Since we have different pairs for Game 1 and Game 2, the subjects are matched again for the second game. However, since we have instructions on paper and inform the subjects about their opponent via these instructions, it will be difficult to reassign the subjects when their

number is less than expected. This restriction of our design result in a little problem in the beginning of the experiment. Moreover, since a class of students of a course is taken as the subject group, the subjects who locate in the same laboratory know and see each other. We also did not have physical barriers to isolate the students. As a result, some students talk to each other.

4) The choice of the objects that players bargain on: We suspect that the choice of objects will affect the conclusion of this experiment. Therefore, with a different pair of objects (that are somehow unrelated) results similar to Roth and Malouf (1979) could have been obtained. In other words, with an appropriate choice of the prizes, one can expect to see the violation of Welfarism axiom as the experiment result.

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# 5 Appendix A: Original version of instructions

**Msn için gerekli bilgiler:**

**Kişi ekleme** : Menü çubuğunda kişiler kısmından kişi ekleme seçilerek, kişinin mail adresi girilip ileri'ye basılır.

**İleti geçmişinin aktif hale getirilmesi:** Menü çubuğundan "araçlar"("tools") kısmından "seçenekler" ("options") seçilir. "İletiler"("Messages") kısmında, "ileti geçmişi"("Message History")nde yer alan "görüşmelerimin geçmişini otomatik olarak sakla"("Save message history automatically.") seçilir.

**Konferans oluşturma**: Konuşmayı gerçekleştirdiğiniz pencerenin üst kısmındaki menü çubuğundan "Eylemler" ("Actions")den "Bir kişiyi bu konuşmaya davet et"(" invite someone to this conversation") seçilir.

**Kişi silme :** Listenizden silmek istediğiniz kişinin üstüne sağ tıklayıp "kişi sil"(delete this person) seçilir.

Ad-Soyad:...............................................................................

Messenger için e-posta adresiniz: ....................@hotmail.com

Bu adres için şifre:.............

**Oyuncu A, piyangoyu kazanırsa, ödülü: 1 Nestle Çikolata**

**Oyuncu B, piyangoyu kazanırsa, ödülü: 1 Nestle Çikolata**

Deneyin bu kısmında sizin rolünüz **Oyuncu A** olmak.

1. 1) Msn messenger'da yukarıdaki adres ve şifreyle oturum açınız.

   2) Daha sonra rasgele belirlenmiş bir kişi olan ....................@hotmail.com kişiyi ve subjectadmn@hotmail.com'u listenize ekleyiniz.

   3) Konuşmayı ........................ ile yapacaksınız fakat ADMIN olan kişi, konuşmalarınızı takip etmek üzere konferansa ekli durumda olmalıdır.

   4) Deney aşağıdaki şekilde gerçekleşecektir.

   a) Oyuncu A ve Oyuncu B için ödülleri sayfa başında belirtildiği gibi olan bir piyango var. Piyangoda birbirlerinin aynısı olan 100 adet bilet var. (Her bilet sahibine kendi ödülü %1 olasılıkla kazanma şansı veriyor).

   b) Siz ve Oyuncu B bu biletleri aranızda paylaştırmak için pazarlık edeceksiniz.

   c) Pazarlık süreci Oyuncu A'nın önerisiyle başlayacak.

   5) Pazarlık süresince aşağıdaki kurallar geçerlidir. Katılım ödülünü (bir quiz notu) hak etmek için aşağıdaki kurallara uymanız gerekmektedir.

   a) Laboratuarda deneyi yapan kişi dışında biriyle konuşmanız yasaktır.

   b) Gönderilecek mesaj sadece $x, y$ ($x =$ Oyuncu A'nın alacağı piyango bileti sayısı, araya bir virgül, $y =$Oyuncu B'nin alacağı piyango bileti sayısı) şeklinde olmalıdır. Bunun dışında mesaj göndermemeniz gerekmektedir.

   c) Deneyin her aşamasındaki oyunlarda pazarlık, deneyi yapan kişinin oyunu başlatmasıyla başlayacaktır, bundan önce diyaloga girilmemesi gerekmektedir.

   d) Her pazarlık oyunu için toplamda 8 dakika süreniz olacak. Bu 8 dakika içinde taraflar arası bir anlaşmaya varılamaması durumunda her iki taraf da anlaşma dahilinde kazanabilecekleri ödülü alamayacaklardır.

e) 8 dakikadan önce anlaşmaya varılması durumunda oyuncular yerlerini terk etmeden diğerlerinin oyunu bitirmelerini beklemelidirler.

6) Piyangoyu kazanan oyuncu sayfa başında yazılı olan ödülünü alır.

7) Anlaşma durumu size gönderilmiş mesajı aynı şekilde geri göndermeniz halinde olacaktır. Örneğin en son öneri olarak $a, b$ geldi, siz de bunu kabul etmek istiyorsanız $a, b$ 'yi karşıdaki kişiye geri göndereceksiniz.

**Oyuncu A piyangoyu kazanırsa ödülü: 2 büyük konserve kutusu dardanel ton balığı**

**Oyuncu B piyangoyu kazanırsa ödülü: 1 büyük konserve kutusu dardanel ton balığı**

Deneyin bu kısmında sizin rolünüz **Oyuncu B** olmak.

1) Deneyin ilk kısmında eklemiş olduğunuz kişiyi listeden silin ve engelleyin.

2) Daha sonra rasgele seçilmiş bir kişi olan ..............@hotmail.com u listenize ekleyin.

3) Bu kişiyle yapılacak konferansa subjectadmn@hotmail.com'u da ekleyiniz

4) Deney aşağıdaki şekilde gerçekleşecektir:

a) Oyuncu A ve Oyuncu B için ödülleri sayfa başında belirtildiği olan bir piyango var. Piyangoda birbirlerinin aynısı olan 100 adet bilet var. (Her bilet sahibine kendi ödülünü %1 olasılıkla kazanma şansı veriyor).

b) Siz ve Oyuncu A bu biletleri aranızda paylaştırmak için pazarlık edeceksiniz.

c) Pazarlık sürecini başlatmak için ilk öneriyi siz yapacaksınız.

5) Pazarlık süresince aşağıdaki kurallar geçerlidir. Katılım ödülünü (bir quiz notu) hak etmek için aşağıdaki kurallara uymanız gerekmektedir.

a) Laboratuarda deneyi yapan kişi dışında biriyle konuşmanız yasaktır.

b) Gönderilecek mesaj sadece $x, y$($x =$ Oyuncu A'nın alacağı piyango bileti sayısı, araya bir virgül, $y =$Oyuncu B'nin alacağı piyango bileti sayısı) şeklinde olmalıdır. Bunun dışında mesaj göndermemeniz gerekmektedir.

c) Deneyin her aşamasındaki oyunlarda pazarlık, deneyi yapan kişinin başlatmasıyla başlayacaktır, bundan önce diyaloga girilmemesi gerekmektedir.

d) Her pazarlık oyunu için toplamda 8 dakika sureniz olacak. Bu 8 dakika içinde taraflar arası bir anlaşmaya varılamaması durumunda her iki taraf da anlaşma dahilinde kazanabilecekleri ödülü alamayacaklardır.

e) 8 dakikadan önce anlaşmaya varılması durumunda oyuncular yerlerini terk etmeden diğerlerinin oyunu bitirmelerini beklemelidirler.

6) Piyangoyu kazanan oyuncu sayfa başında yazılı olan ödülünü alır.

7) Anlaşma durumu size gönderilmiş mesajı aynı şekilde geri göndermeniz halinde olacaktır. Örneğin en son öneri olarak $a, b$ geldi, siz de bunu kabul etmek istiyorsanız $a, b$ 'yi karşıdaki kişiye geri göndereceksiniz.

# 6 Appendix B: Translated version of the instructions

**Necessary Information for Msn Messenger**:

**Add Contact** : From the "persons" part of menu bar, "add contact" is chosen. By writing the mail address of the contact, it is proceeded to next.

**Activation of the message history**: From the "tools" part of the menu bar, "options" is chosen. "Save message history automatically." that locates in "Message History" of "Messages" part, is chosen.

**Conference:** In the menu bar of the conversation window, from "Actions"," invite someone to this conversation" is chosen.

**Delete contact :** For the ones that you want to remove from your contact list, by right clicking on their name, you should choose "delete this person".

Name & Surname:...............................................................................................

E-mail address for Messenger: ......................@hotmail.com

Password for this address:.............

**If Player A wins the lottery, his/her prize: 1 Nestle Chocolate bar**

**If Player B wins the lottery, his/her prize: 1 Nestle Chocolate bar**

In this part of the experiment your role is to be **Player A**.

1) Log in Msn messenger with the email address and password above.

2) Add a contact who is determined randomly................@hotmail.com and subjectadmn@hotmail.com to your contact list.

3) You will have conversation with ................ but experimenter should be added to your conference to follow your conversation.

4) The experiment will be performed in the following way.

a) There is a lottery which has prizes for Player A and Player B as declared in the beginning of the page. There are 100 tickets in the lottery. Each has the same weight. (Each ticket gives 1% chance to its owner to win his/her prize).

b) You and Player B will bargain on the division of these tickets.

c) The bargaining process will start with your offer.

5) During the bargaining process the following rules are valid. In order to obtain participation award (one quiz grade) you should obey the following rules.

a) It is banned for you to talk to anyone else except the experimenter.

b) The proposal that is sent should be in the following format: x, y (x = the lottery ticket numbers that Player A will take, y = the lottery ticket numbers that Player A will take). You are not allowed to send any other messages.

c) In each session of the experiment, bargaining process will begin with the start call of the experimenter, there should not be any conversation before this call.

d) You will have 8 minutes to complete bargaining. Unless the bargainers could reach an agreement in 8 minutes, both sides cannot take their prizes in the case of agreement.

e) In the case of an agreement before 8 minutes, the players should wait the other players to complete their bargaining.

6) The player who wins the lottery will take the prize that is written in the beginning of the page for him/her.

7) The agreement will be in the case of sending a coming message in the same way. For instance, a, b has come as the last offer, if you want to accept a, b you should send it back to your opponent.

**If Player A wins the lottery, his/her prize: 2 canned tuna**

**If Player B wins the lottery, his/her prize: 1 canned tuna**

In this part of the experiment your role is to be **Player B**.

1) Delete the person that you added in the first part of the experiment.

2) Add as a contact who is determined randomly ....................@hotmail.com.

3) Add subjectadmn@hotmail.com to the conference that you will have with this person.

4) The experiment will be performed in the following way.:

a) There is a lottery which has prizes for Player A and Player B as declared in the beginning of the page. There are 100 tickets in the lottery. Each has the same weight. (Each ticket gives 1% chance to its owner to win his/her prize).

b) You and Player A will bargain on the division of these tickets.

c) The bargaining process will start with the Player A's offer.

5) During the bargaining process the following rules are valid. In order to obtain participation award (one quiz grade) you should obey the following rules.

a) It is banned for you to talk to anyone else except the experimenter.

b)The proposal that is sent should be in the following format: x, y (x = the lottery ticket numbers that Player A will take, y = the lottery ticket numbers that Player A will take). You are not allowed to send any other messages.

c) In each session of the experiment, bargaining process will begin with the start call of the experimenter, there should not be any conversation before this call.

d) You will have 8 minutes to complete bargaining. Unless the bargainers could reach an agreement in 8 minutes, both sides cannot take their prizes in the case of agreement.

e) In the case of an agreement before 8 minutes, the players should wait the other players to complete their bargaining.

6) The player who wins the lottery will take the prize that is written in the beginning of the page for him/her.

7) The agreement will be in the case of sending a coming message in the same way. For instance, a, b has come as the last offer, if you want to accept a, b you should send it back to your opponent.